TRANSLATION FROM JAPANESE

(19) Japanese Patent Office (JP)	(12) Official Gazette for Laid-Open Patent Applications (A)	(11) Japanese Unexamined Patent Application (Kokai) No. **5-56902**

(43) Disclosure Date: March 9, 1993

(51) Int. Cl.[5]	Class. Symbols	Internal Office Registr. Nos.	F I
A 47 L 13/16		A 2119-3b	
D 04 H 1/46		A 7199-3B	

Request for Examination: Not filed   Number of Claims: 3 (Total of 7 pages [in original])

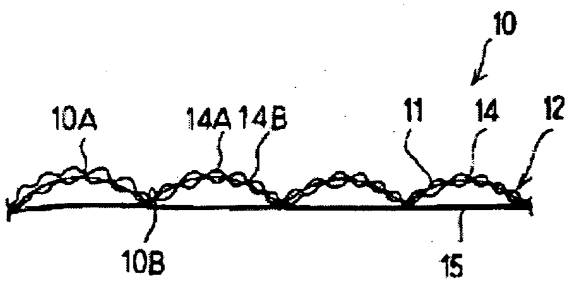
(21) Application No.: 3-221844 (22) Filing Date: Sept. 2, 1991	(71) Applicant: 000000918 Kao Corp. (72) Inventor: Shinya Sato (74) Agent: Osamu Hattori, Patent Attorney

(54) [Title of the Invention] **Cleaning Sheet and Its Production**

(57) [Abstract]

[Object] To provide a cleaning sheet with a certain level of strength and a better dust-trapping capacity, and a method for producing it.

[Structure] The cleaning sheet of the invention 10 comprises a first sheet 12, itself comprising a reticulated sheet 11 and fiber aggregates 14 united through the interlacing of the fibers, the first sheet 12 being integrally joined in places to a second sheet 15, which is a heat shrinking sheet, characterized in that relatively small numerous first protrusions and depressions 14A and 14B are formed on the surface of the first sheet 12, and all of the first sheet 12 forms relatively large second protrusions and depressions 10A and 10B on the second sheet 15.



[Claims]

[Claim 1] A cleaning sheet comprising a first sheet, itself comprising a reticulated sheet and fiber aggregates united through the interlacing of the fibers, the first sheet being integrally joined in places to a second sheet which is heat shrinkable, said cleaning sheet characterized in that relatively small numerous first protrusions and depressions and are formed on the surface of the first sheet, and all of the first sheet forms relatively large second protrusions and depressions and on the second sheet.

[Claim 2] A method for producing a cleaning sheet, characterized by comprising the steps of:

forming a first sheet by laminating fiber webs to or both sides of a heat shrinkable reticulated sheet and then interlacing the reticulated sheet and the fiber webs together;

forming relatively small first protrusions and depressions on the surface of the first sheet by heating the first sheet to shrink the reticulated sheet; and

joining the first sheet in places to the heat shrinkable second sheet to unite those sheets, and then heating the first and second sheets to shrink the second sheet, so that the entire first sheet forms relatively large second protrusions and depressions.

[Claim 3] A method for producing a cleaning sheet, characterized by comprising the steps of:

forming a first sheet by laminating fiber webs to or both sides of a heat shrinkable reticulated sheet and then interlacing the reticulated sheet and the fiber webs together;

forming relatively small first protrusions and depressions on the surface of the first sheet by heating the first sheet to shrink the reticulated sheet; and

joining the first sheet in places to the heat shrinkable second sheet to unite those sheets; and

then heating the first and second sheets while united to shrink the reticulated sheet and second sheet, thereby simultaneously forming the first and second protrusions and depressions.

[Detailed Description of the Invention]

[0001]

[Field of Industrial Application]

The present invention relates to a cleaning sheet with protrusions and depressions formed on the surface of the sheet, and in particular to a cleaning sheet used for business and household purposes, and its production.

[0002]

[Prior Art]

Cleaning sheets are generally in the form of simple sheets such as dust cloths and wipes, which are moist or dry cleaning sheets involving the use of woven or nonwoven sheets, etc., or those in the form of strings, such as mops, which are bundled. These are used in a wide range of areas, depending on the intended use, such as households, offices, retail outlets, office buildings, and plants.

[0003]

It is known that such sheets can be embossed to provide them with protrusions and depressions to improve bulk. For example, paper or nonwoven fabric can be passed through embossing rolls to provide such protrusions and depressions. However, problems in conventional cleaning sheets are that the protrusions and depressions cannot be preserved for very long in the presence of aqueous materials or when subject to tensile stress.

[0004]

To overcome such drawbacks, Japanese Unexamined Patent Application (Kokai) 64-61546 disclosed a technique for stitching nonwoven fabric with elastic thread so that the fabric

became gathered, providing protrusions and depressions. Japanese Unexamined Patent Applications (Kokai) 61-215754 and 2-160962 disclosed techniques for partially joining fibers with the latent capacity to develop thermal crimp with nonheat-shrinking fibers forming a nonwoven fabric, and heating them to produce protrusions and depressions.

[0005]

[Problems Which the Invention Is Intended to Solve]

However, in the former technique, the protrusions and depressions formed on the sheet can be preserved, but the nonwoven fabric forming the sheet cannot be made bulky, resulting in a lower degree of fiber freedom, which does not allow the dust to become sufficiently entangled and leads to an unsatisfactory dust-trapping capacity.

[0006]

Although the nonheat-shrinkable fibers parts forming the sheet in the latter technique do develop bulky texturing, the textured patterning is smaller and is not capable of trapping larger types of dirt. Furthermore, in the latter technique, the nonheat-shrinkable fibers are strongly interlaced with the parts formed by the fibers with a latent thermal crimp developing capacity. The resulting low degree of fiber freedom does not allow larger types of dirt to be trapped, as is the case in the former technique as well. On the other hand, bulky sheets with a high degree of fiber freedom generally have looser interlacing of the structural fibers, resulting in dramatically lower cleaning sheet strength.

[0007]

An object of the invention is thus to provide a cleaning sheet with a certain level of strength and a better dust-trapping capacity, and a method for producing it.

[0008]

[Means for Solving the Abovementioned Problems]

The present invention is intended to achieve the above objects by providing a cleaning sheet comprising a first sheet, itself comprising a reticulated sheet and fiber aggregates united through the interlacing of the fibers, the first sheet being integrally joined in places to a second sheet which is heat shrinkable, said cleaning sheet characterized in that relatively small numerous first protrusions and depressions and are formed on the surface of the first sheet, and all of the first sheet forms relatively large second protrusions and depressions and on the second sheet.

[0009]

The invention is also intended to provide a method for producing a cleaning sheet, characterized by comprising the steps of: forming a first sheet by laminating fiber webs to or both sides of a heat shrinkable reticulated sheet and then interlacing the reticulated sheet and the fiber webs together; forming relatively small first protrusions and depressions on the surface of the first sheet by heating the first sheet to shrink the reticulated sheet; and joining the first sheet in places to the heat shrinkable second sheet to unite those sheets, and then heating the first and second sheets to shrink the second sheet, so that the entire first sheet forms relatively large second protrusions and depressions.

[0010]

The invention is furthermore intended to provide a method for producing a cleaning sheet, characterized by comprising the steps of: forming a first sheet by laminating fiber webs to or both sides of a heat shrinkable reticulated sheet and then interlacing the reticulated sheet and the fiber webs together; forming relatively small first protrusions and depressions on the surface of the first sheet by heating the first sheet to shrink the reticulated sheet; and joining the first sheet in places to the heat shrinkable second sheet to unite those sheets; and then heating the first and second sheets while united to shrink the reticulated sheet and second sheet, thereby simultaneously forming the first and second protrusions and depressions.

[0011]

The "fiber aggregates" referred to in the invention are constituent fibers that have been interlaced. "Fiber webs" are the constituent fibers prior to interlacing treatment.

[0012]

[Action]

In the cleaning sheet of the invention, the large second protrusions and depressions formed on the entire cleaning sheet allow relatively large types of dirt to be trapped, and the relatively smaller first protrusions and depressions formed on the fiber aggregates allow relatively smaller types of dirt to be trapped, thereby allowing many types of dirt to be trapped, either by being entangled by fibers having a high degree of freedom over all or by being trapped in the spaces between the constituent fibers.

[0013]

[Examples]

Examples of the invention are illustrated in detail below with reference to the attached drawings. Figure 1 is an oblique view of an example of the cleaning sheet in the invention. Figure 2 is a cross section of the sheet in Figure 1 along line II-II. Figure 3 is a cross sectional detail of the sheet illustrated in Figure 2. Figure 4 is a plan of a net used as the reticulated sheet. Figure 5 is a schematic of manufacturing equipment suitable for use in the production of the cleaning sheet illustrated in Figure 4. Figure 6 is a plan of fiber aggregates used as the reticulated sheet. Figure 7 is a plan of porous films used as reticulated sheets.

[0014]

The cleaning sheet 10 in this example, as illustrated in Figure 1 through 4, comprises a first sheet 12, itself comprising a reticulated sheet 11 and fiber aggregates 14 united through the interlacing of the fibers, the first sheet 12 being integrally joined in places to a second sheet 15, which is a heat shrinking sheet, characterized in that relatively small numerous first protrusions and depressions 14A and 14B are formed on the surface of the first sheet 12, and all of the first sheet 12 forms relatively large second protrusions and depressions 10A and 10B on the second sheet 15.

[0015]

The first sheet 12 is formed when fiber aggregates 14 in the form of nonwoven fabric formed by the interlacing of fibers are united with one or both sides of a reticulated sheet 11 while the constituent fibers of the aggregates are interlaced together and with the reticulated sheet 11. Relatively small first protrusions and depressions 14A and 14B are formed on the first sheet 12 by shrinking the reticulated sheet 11. The nonwoven fabric thus formed by the interlacing of the fibers has a greater degree of fiber freedom than nonwoven fabrics formed solely by the fusion or adhesion of the fibers. As this results in extremely good entanglement between dirt and the fibers, as well as dirt retention, the dust trapping capacity is better.

[0016]

The first sheet 12 is furthermore joined in places to one or both sides of a heat shrinkable second sheet 15. The heat shrinkable second sheet 15 is shrunk, so that second protrusions and depressions 10a and 10B which are larger than the first protrusions and depressions 14A and 14B are formed on the second sheet 15 throughout the cleaning sheet as a whole. That is, relatively

small first protrusions and depressions 14A and 14B as well as relatively large second protrusions and depressions 10A and 10B are formed on the cleaning sheet 10.

[0017]

The heat shrinkable net 11a serving as the reticulated sheet 11 is latticed over all, as illustrated in Figure 4. Examples of fibers used in the fiber aggregates 14 include thermoplastic fibers such as polyesters, polyamides, polyolefins, and acrylics, conjugated fibers thereof, semi-synthetic fibers such as acetate, regenerated fibers such as rayon and cupra, and natural fibers such as cotton, as well as mixtures thereof. The basis weight, denier, fiber length, cross section, degree of interlacing, and strength should be determined as befits the intended use upon a comprehensive consideration of processability and costs, etc. The basis weight before being shrunk to the desired size should be 15 to 150 g/m^2. Less than 15 g/m^2 will not result in the necessary interlacing or strength, so that when used as a cleaning sheet, the material tends to shed fibers. More than 150 g/m^2 is economically disadvantageous.

[0018]

The denier of the fiber aggregates 14 will affect interlacing, but 0.5 to 6.0 is suitable. Less than 0.5 denier will result in poor web formability, while more than 6.0 denier will complicate interlacing, resulting in a poor dust trapping capacity. Surfactants or oils for improving the surface properties of the nonwoven fabric fiber aggregates 14 for better dust adsorption or oils for improving the luster of the cleaned surface and the like may also be added as befits the intended function of the sheet.

[0019]

The reticulated sheet 11 should be heat shrinkable. When a net 11a is used as the reticulated sheet, a net 11a composed of a thermoplastic polymer, for example, a polyolefin such as polyethylene, polypropylene, and polybutene, a polyester such as polyethylene terephthalate and polybutylene terephthalate, vinyl and vinylidene, such as polyvinyl chloride and polyvinylidene chloride, a polyamide such as nylon 6 and nylon 66, or variants and mixtures of the above, should be shrunk uniaxially or biaxially according to the necessary textured shape, or thermoplastic filaments of the above polymers should be used for at least the warp or weft to weave or knit a net. This should be determined based on the first protrusions and depressions 14A and 14B that are needed.

[0020]

The size of the lattice, the line diameter, and the like of the net 11a used as the reticulated sheet 11 must be determined upon a consideration of the extent and shape of the protrusions and depressions resulting from the shrinking force and shrinking rate, the partial interlaceability with the fiber aggregates of the nonwoven fabric, and the like. Specifically, the line diameter should be 20 to 500 μ, and preferably 100 to 200 μ. The shape of the lattice is not particularly limited, but the aperture area should be 4 to 900 mm^2, and preferably 10 to 200 mm^2. When the aperture area of the net 11a lattice is greater than 4 mm^2, it will be easier to form protrusions on the pore areas of the net 11a to ensure that the fibers of the fiber aggregates on either side of the net 11a are firmly interlaced to each other through the pores of the net 11a. On the other hand, if the lattice is small and the line diameter is large, it is easier to form depressions in the pore areas of the net 11 a, in contrast to the above case, because of greater interlacing between the fibers on the surface of the net lines and between fibers on the other side.

[0021]

A film of a thermoplastic polymer, for example, a polyolefin such as polyethylene, polypropylene, and polybutene, a polyester such as polyethylene terephthalate and polybutylene terephthalate, vinyl and vinylidene, such as polyvinyl chloride and polyvinylidene chloride, a polyamide such as nylon 6 and nylon 66, or variants and mixtures of the above, should be shrunk uniaxially or biaxially as the heat shrinkable second sheet 15, according to the shape needed of the secondary protrusions and depressions.

[0022]

The thickness of the second sheet 15 must be determined upon a consideration of the extent and shape of the protrusions and depressions resulting from the shrinking force and shrinking rate, the partial interlaceability with the fiber aggregates of the nonwoven fabric, and the like, but is preferably about 10 to 40 μm. The resin of the second sheet 15 should also be selected upon a consideration of the interlaceability with the fiber aggregates 14 of the nonwoven fabric. Preferred embodiments for producing the cleaning sheet of the invention will be described below with reference to Figure 5.

[0023]

Fiber webs are laminated to one or both sides of the uniaxially or biaxially heat shrinkable reticulated sheet 11, and the fibers of the fiber web on one side of the reticulated sheet 11 are interlaced by running water or the like with the fibers of the fiber web on the other side, and the fibers of the fiber webs are also interlaced with the reticulated sheet. At the same time, the interlacing of the fiber webs results in fiber aggregates 14 in the form of a nonwoven fabric. The heat shrinkable reticulated sheet 11 is then heat shrunk, either at the same time as or separately from the step in which the resulting fiber aggregates 14 are dried, so that portions of the nonwoven fabric fiber aggregates 14 are provided with first protrusions and depressions 14A and 14B overall, forming the first sheet 12.

[0024]

The uniaxially or biaxially heat shrinkable second sheet 15 is joined to the fiber aggregates 14. To join them, an adhesive can be applied in a pattern on at least one of either the second sheet 15 or nonwoven fabric, or they can be heated and pressed. When joined using an adhesive, it will be necessary to use an adhesive with sufficient adhesive strength to avoid separation when the heat shrinkable second sheet 15 is heat shrunk, and it will also be necessary to ensure that the adhesive does not seep onto the side that is not to be joined with the fiber aggregates 14 of the nonwoven fabric, for the sake of stable processability. To heat and press the sheet and aggregates together, it will be necessary to select a material that will fuse with the second sheet 15 or nonwoven fabric fiber aggregates 14, or that will join them with an anchoring effect. The joining pattern can be provided by an embossing roll. Specific examples include heat embossing and ultrasonic embossing, which should be selected depending on the processing speed and materials that are used. After the sheet and aggregates have been joined by either method, the materials are treated at a temperature for a period of time to unit the first sheet 12 and second sheet 15. Although the conditions will depend on the heat shrinkable second sheet 15, they should be set so that the shrinkage results in the necessary second protrusions and depressions 10A and 10B. However, it should be possible to control the shrinkage of the second sheet 15 at a temperature lower than the temperature at which the reticulated sheet 11 shrinks. The embossing pattern may be continuous lines or discontinuous dot patterns. However, the size of one enclosed pattern must be larger than the first protrusions and depressions 14A and 14B provide on the fiber aggregates 14 by the reticulated sheet 11. The interval between parallel lines

or those in similar patterns must be greater than the first protrusions and depressions 14A and 14B. The width of the lines or dots forming the embossed pattern should be 0.1 to 5 mm. Less than that will result in weak adhesive force, while more than that will result in less effective surface area on the cleaning sheet.

[0025]

In order to simultaneously implement the heat treatment for providing the relatively small protrusions and depressions 14A and 14B on the nonwoven fabric fiber aggregates and the heat treatment for providing the relatively larger second protrusions and depressions 10A and 10B, the various shrinking rates will have to be pre-adjusted so that the second protrusions and depressions 10A and 10B reach the target size at the treatment temperature. The shrinkage of the nonwoven fabric fiber aggregates 14 must be subtracted in order to obtain second protrusions and depressions 10A and 10B of the target size.

[0026]

When continuously joined sheets are shrunk in the machine direction, the difference in the speeds at the inlet and outlet of the heat treatment part is an important point. That is, when the tensile stress is greater than the shrinking force, the shrinking rate will be close to the vertical velocity ratio. Figure 5 illustrates an embodiment of a method for producing the cleaning sheet. Fiber webs are continuously fed out by a feed roll 22 from card machines 21A and 21B (for producing fiber webs).

[0027]

A roll 23 for the reticulated sheet 11 is located between the card machines 21 and 21B, and the reticulated sheet 11 is fed out by a feed roll 25. Fiber webs are placed by the feed roll 22 on both sides of the reticulated sheet 11 and conveyed to the water needling device 26. As a result of the jet water flow here, the fibers of the fiber webs are interlaced with the reticulated sheet 11, and the fiber webs 14 on either side of the reticulated sheet 11 are interlaced together, forming fiber aggregates 14.

[0028]

The interlaced fiber aggregates 14 are then conveyed through the nip roll 27 to the heating device 28 to dry and shrink them. The heat treatment forms the first protrusions and depressions 14A and 14B on the firs sheet 12. The first sheet 12 with the first protrusions and

depressions 14A and 14B then passes through the nip roll 29 and is laminated by a nip roll 30 to the heat shrinkable second sheet 15 supplied from rolls. The first sheet 12 and the heat shrinkable second sheet 15 are then partially joined by ultrasonic embossing units 31A and 31B.

[0029]

The joined first sheet 12 and second sheet 15 are conveyed through the nip roll 32 to the heating device 33 and are heat treated to produce the second protrusions and depressions 10A and 10B. After the heat treatment, the cleaning sheet 10 is passed through the nip roll 34 and taken up by a take up roll 36. The sheet may also be cut to the desired length without being taken up by the roll 36, and folded as needed for packaging.

[0030]

The heat treatment device 28 is not particularly necessary. The sheet may also be heated with just a heating device 33. The cleaning sheet of the invention is illustrated in greater detail based on the following specific examples.

Example 1

51 mm polyester fibers with a denier of 1.5 were used to form a web with a basis weight of 10 g/m^2 by means of an ordinary card. Five layers of such webs (basis weight of 50 g/m^2) were lapped (not shown), the webs were laminated as upper and lower layers on either side of an intermediate layer consisting of a polypropylene biaxially shrinking net (aperture area: 100 mm^2/line diameter 0.2 mm/shape: square), and they were interlaced by water needling. The water needling pressure was 40 kg/cm^2, the nozzle pitch was 1.6 mm, and the rate was 5 m/min. The sheet was then thoroughly dried at 100°C and then heat treated for 60 seconds at 140°C to shrink the net 11a, giving a first sheet 12 with first protrusions and depressions 14A and 14B with a shrinkage of about 10%. A polypropylene biaxially shrinking sheet (thickness: 15 μ) was laminated as the heat shrinkable second sheet 15 to the first sheet 12, they were joined with a 30° rhomboidal pattern 30 mm on a side by ultrasonic embossing, and a cleaning sheet 10 with about 10% shrinkage was obtained by 30 seconds of heat treatment at 100°C.

[0031] Comparative Example

51 mm polyester fibers with a denier of 1.5 were used to form a web with a basis weight of 10 g/m^2 by means of an ordinary card. Ten layers of such webs (basis weight of 100 g/m^2) were lapped (not shown), and they were interlaced by water needling. The water needling

pressure was 40 kg/cm^2, the nozzle pitch was 1.6 mm, and the rate was 5 m/min. The sheet was then thoroughly dried at 100°C, giving a cleaning sheet.

[0032]

The heat shrinkage was calculated by the following formula.

Heat shrinkage (%) = ((X-Y)/X) × 100

In the formula, X is the length on one side before heat shrinkage, and Y is the length on one side after. The example of the invention and the comparative example were used to clean objects. Table 1 gives the results of the dust trapping capacity.

[0033]

[Table 1]

Classification	Types of dirt and retention			Overall
	cotton dust	bread crumbs	hair	
Example 1	O	O to *	*	O to *
Comparative Ex.	O	× to Δ	Δ	Δ

*: good

O: fair

Δ: somewhat poor

×: poor

Table 1 shows that the example of the invention was better than the comparative example when it came to trapping cotton dust, relatively large types of dirt such as bread crumbs, as well as long, rigid types such as hair. It was thus able to clean a greater range of types of dirt than conventional cleaning sheets (comparative product).

[0034] Example 2

51 mm polyester fibers with a denier of 1.5 were used to form a web with a basis weight of 10 g/m^2 by means of an ordinary card. Five layers of such webs (basis weight of 50 g/m^2) were lapped (not shown). 50 mm rayon fibers with a denier of 1.5 were also used to form a web with a basis weight of 10 g/m^2 by means of an ordinary card, and five layers of such webs (basis weight of 50 g/m^2) were also lapped (not shown). The webs were laminated as upper and lower layers on either side of an intermediate layer consisting of a polypropylene biaxially shrinking net

(aperture area: 100 mm²/line diameter 0.2 mm/shape: square), and they were interlaced by water needling. The water needling pressure was 40 kg/cm², the nozzle pitch was 1.6 mm, and the rate was 5 m/min. The sheet was then thoroughly dried at 100°C. A hydrophilicizing oil was sprayed as a wetting agent on the surface made of the polyester fibers. The layers were then heat treated for 60 seconds at 140°C to shrink the net 11a, giving a first sheet 12 with first protrusions and depressions 14A and 14B with a shrinkage of about 10%. A polypropylene biaxially shrinking sheet (thickness: 15 μ) was laminated as the heat shrinkable second sheet 15 to the rayon surface of the first sheet 14 [sic], they were joined with a 30° rhomboidal pattern 30 mm on a side by ultrasonic embossing, and a cleaning sheet 10 with about 10% shrinkage was obtained by 30 seconds of heat treatment at 100°C.

[0035]

The second example had far better moisture absorption that the first example, without sacrificing the dust trapping capacity. The invention is not limited to the above examples, and is capable of various variants within the scope of the invention. For example, the reticulated sheet 11 can be in the form of the reticulated sheet 11b consisting of fiber aggregates in Figure 6. The reticulated sheet 11b consisting of such fiber aggregates can be made of thermoplastic fibers comprising monofilament polymers and copolymers such as ethylene, propylene, or butene, or high density polyethylene, low density polyethylene, linear low density polyethylene, polypropylene, ethylene-propylene copolymers, ethylene-vinyl acetate copolymers, etc., or ester polymers or copolymers such as polyethylene terephthalate and polybutylene terephthalate, vinyl copolymers such as polyvinyl chloride or polyvinylidene chloride, polyamide polymers and copolymers such as nylon 6 and nylon 66, acrylonitrile polymers and copolymers, or mixtures thereof; or fibers with latent thermal crimp formability by which crimping is developed upon being heated; or mixtures thereof. The fibers are joined while interlaced. The reticulated sheet 11b consisting of such fiber aggregates is obtained when the constituent fibers of the fiber webs consisting of latent heat crimping fibers are arranged in the form of a net by means of high speed running water or gas, resulting in a reticulated sheet 11b with openings in the form of a net. Alternatively, the latent heat crimping fibers can be interlaced, and the resulting sheet can be punched to provide holes 18.

[0036]

Porous films 11c with numerous pores, as illustrated in Figure 7, may also be used. Such porous films 11c can be made of the aforementioned polymers, and uniaxially or biaxially shrinking films can be punched out or the like to provide the holes. Fiber aggregates 11b of latent heat crimping fibers and heat shrinkable porous films 11c with holes can also be provided with holes over all by means of the openings 18 illustrated in Figures 6 and 7.

[0037]

When fiber aggregates 11b of latent heat crimping fibers and heat shrinkable porous films 11c are used as the reticulated sheet 11, the interval between the closes adjacent holes should be 2 to 20 mm, and preferably 4 to 10 mm. The hole pattern is not particularly limited, but the aperture area should be 10 to 2000 mm^2, and preferably 50 to 500 mm^2.

[0038]

[Merit of the Invention]

The cleaning sheet of the invention has a certain degree of strength and a better dust trapping capacity. Compared to conventional cleaning sheets which have oils to improve the dust adsorption strength, the cleaning sheet of the invention allows less oil to be used. There is thus less chance of such oils migrating on the cleaned surface to alter or discolor the cleaned surface, or of the oil getting onto the hands, etc.

[0039]

The methods for producing the cleaning sheet of the invention allow the sheet to be readily produced.

[Brief Description of the Figures]

Figure 1 is an oblique view of an example of the cleaning sheet in the invention.

Figure 2 is a cross section of the sheet in Figure 1 along line II-II.

Figure 3 is a cross sectional detail of the sheet illustrated in Figure 2.

Figure 4 is a plan of a net used as the reticulated sheet.

Figure 5 is a schematic of manufacturing equipment suitable for use in the production of the cleaning sheet illustrated in Figure 4.

Figure 6 is a plan of fiber aggregates used as the reticulated sheet.

Figure 7 is a plan of porous films used as reticulated sheets.

[Legends]

10: cleaning sheet

10A: second protrusions

10B: second depressions

11: reticulated sheet

12: first sheet

14: fiber aggregates

14A: first protrusions

14B: first depressions

15: second sheet

Figure 2

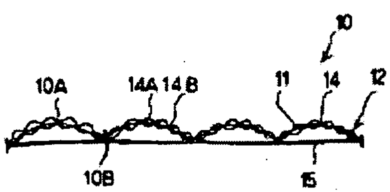


Figure 3

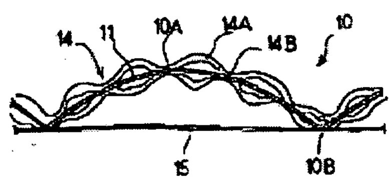


Figure 1

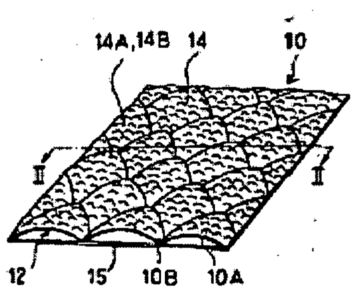


Figure 4

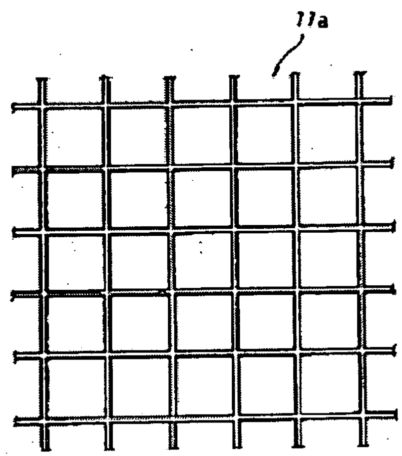


Figure 5

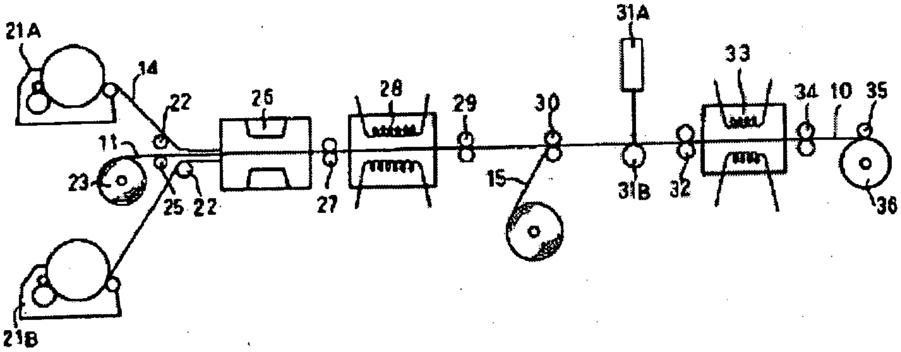


Figure 6

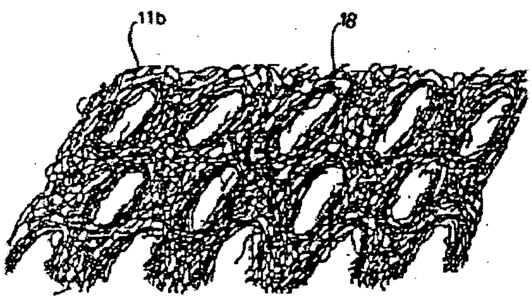


Figure 7